Astronomy

ES-2 The student will demonstrate an understanding of the structure and properties of the universe.

Key Concepts for ES-2:
Solar System: formation, properties, planets
Moon: properties & features, uniqueness
Big Bang Theory: expansion of the universe; red shift
Formation of elements: nuclear fusion; supernova
Hertzsprung-Russell diagram:
Telescopes: visual – reflecting & refracting; x-ray; radio
Life Cycle of Stars: birth, main sequence, death – supernova, black hole
Galaxies: formation & shapes, effects of gravity & motion
Technology & Computer Modeling:

ES-2.1 Summarize the properties of the solar system that support the theory of its formation along with the planets.
Taxonomy level: 2.4-B Understand Conceptual Knowledge

Previous/future knowledge: Students in 4th grade (4-3.1) recalled Earth as one of many planets in the solar system. The characteristics and movements of objects in the solar system were introduced in 8th grade (8-4.1). Students have not been introduced to the theory of the formation of the solar system.

It is essential for students to know properties that are evident within the solar system that support the *nebular theory* of its formation.

- Stars and planets form from clouds of gas and dust, called interstellar clouds that exist between the stars. This interstellar cloud material can be observed in regions along the Milky Way.
- The collapsing of interstellar cloud material along with its rotating motion is the beginning of the flattened rotating disk that became the solar system.

The nebular theory continues to explain the formation of the Sun and then planetesimals, many of which formed the planets.

- The terrestrial/rocky planets near the Sun formed from denser elements and compounds such as iron and silicon that were not driven away by energy radiating from the forming Sun.
- The outer planets formed farther from the Sun where energy levels were lower.
- Other remnants from solar system formation are asteroids and comets.

It is not essential for students to know physics, such as angular momentum, behind the formation process or the specific formation of the individual bodies within the solar system.

Assessment Guidelines:
The objective of this indicator is to *summarize* major points about the formation of the solar system; therefore, the primary focus of assessment should be to generalize major points about the nebular theory.
In addition to *summarize*, appropriate assessments may require students to:

- *compare* the formation of the inner and the outer planets;
- *sequence* the events in the formation of the solar system; or
- *identify* objects that formed in the solar system.